Positioning and attachment interventions for nipple pain: a systematic review

Positioning and attachment interventions for nipple pain: a systematic review

Sharon Guille, Marlene Sinclair, Brendan Bunting, Bernie Reid, Paul A McCarron

ORIGINAL

Background: Nipple pain is a common difficulty experienced by breastfeeding mothers, with negative impacts on breastfeeding duration and experience. Previous systematic reviews, focusing mainly on various topical treatments, dressings and protective devices for nipple pain, concluded there was insufficient evidence to recommend any of these interventions, advocating correct positioning and attachment for the prevention of pain and trauma. Achieving optimal positioning and attachment forms the basis of management advice for nipple pain.

Aim: The aim of this review was to collate and synthesise current evidence for the effectiveness of positioning and attachment interventions for the prevention and/or management of nipple pain in breastfeeding mothers. Other outcomes included identifying factors associated with effective intervention design and also examining the effectiveness of positioning and attachment interventions for nipple pain on breastfeeding duration.

Methods: The scope of the review was defined using the PICOS tool. Literature searches were conducted on the following databases: MEDLINE, Embase, PsycInfo, CINAHL, Proquest Academic Complete, Web of Science and the Cochrane Central Register of Controlled Trials (CENTRAL). A search of the grey literature was also undertaken. A risk of bias analysis was completed for included studies.

Results: Following the search and having removed duplicates, 163 records were screened by title and abstract. 152 studies were excluded for reasons including: non-experimental study design, the testing of interventions outside the scope of this review or interventions targeted at dyads who may find breastfeeding more challenging. Of the 11 full text articles assessed for eligibility, three studies involving 489 participants met the full inclusion criteria. Owing to the low number of studies, variations in design and conflicting results, there is insufficient evidence to determine the effectiveness of positioning and attachment interventions for nipple pain. Subsequently, there is not enough information to recommend any specific intervention study design or to determine the impact on breastfeeding duration.

Conclusion: This review highlights the need to invest in further research focused on positioning and attachment interventions for nipple pain. Further studies will help identify factors associated with effective intervention delivery and consider if these interventions improve breastfeeding technique. Studies should also examine pain severity through the use of measurement tools and include a thorough pain assessment, prior to intervention delivery, to determine intervention effectiveness.

Key words: breastfeeding, positioning and attachment, intervention, nipple pain, duration, systematic literature review, evidence based midwifery

Background

Description of the condition

Breastfeeding is considered the optimum source of infant nutrition, with the recommendation that infants should be exclusively breastfed for the first six months of life, and thereafter receive complementary foods along with breastfeeding until the age of two years or beyond (World Health Organization 2003, 2011). Despite the growing evidence for the benefits of breastfeeding, and implementation of global as well as regional policies, strategies and initiatives based on recommendations from the World Health Organization and UNICEF Baby Friendly Initiative, exclusive breastfeeding and breastfeeding duration rates remain below the recommendations.

The reasons why women choose not to breastfeed or to discontinue early can be varied and complex and '*range from the medical, cultural and psychological*

to physical discomfort and inconvenience' (The Lancet Breastfeeding Series, 2016:404). It has been documented that for those who choose to breastfeed (n=1177), as many as 60% (n=706) stopped earlier than desired (Odom at al 2013). Nipple pain is one of the most common reasons given by mothers for stopping breastfeeding, second to perceived low milk supply (Odom et al 2013, Buck et al 2014). Incidences of nipple pain and trauma vary in the literature from between 34–96% of breastfeeding women (Dennis et al 2014). Research suggests that the greatest appearance of trauma happens in the first week after childbirth (Dias et al 2017) with pain peaking by day 3 (Lucas et al 2016) and reducing to mild levels after seven to 10 days postpartum (Dennis et al 2014). Concerns between days 3 and 7 have been associated with a greater risk of breastfeeding cessation (Wagner et al 2013). Other research, however, reports 8% (27/340) of women continue to experience nipple damage and 20% (68/340) of women continue to experience nipple pain at eight weeks postpartum (Buck et al 2014). Research by Li et al (2008), using data from the Infant Feeding Practices Study II (IFPS II), reported lactation (including painful breastfeeding and sore nipples) and nutrition issues were the most frequently cited reasons for stopping breastfeeding during the first two months. While painful nipples are cited as a common reason for stopping breastfeeding, many women with painful nipples continue to breastfeed, with negative impacts on their breastfeeding experience. In addition to the physical pain and the risk of infection, nipple pain can cause psychological distress and interfere with the general activity, mood, and sleep of mothers as well as impacting on the bonding process (McClellan et al 2012). Other research suggests that breastfeeding experience, rather than duration, is predictive of depressive symptoms, with mothers who stop specifically due to pain or physical difficulties being at a greater risk (Brown et al 2016). Resulting anxiety from nipple pain may also inhibit the let-down reflex, and lead to reduced frequency and length of breastfeeds, subsequently affecting milk supply (Pollard 2017).

Numerous causes of nipple pain have been documented in the National Institute for Health and Care Excellence (NICE) publication *Breastfeeding problems*, including physiological causes, nipple damage, blocked ducts, nipple infection (bacterial, candida infection), skin conditions and nipple vasospasm or Raynaud's disease of the nipple. More than one cause may co-exist (NICE 2017). The *Postnatal care up to 8 weeks after birth* guidance informs that in the event of painful or cracked nipples, mothers should be advised this is '*probably due to incorrect attachment*' (NICE 2006:24). Other literature reports incorrect positioning and attachment as a contributing cause of nipple pain in 90% of cases, with the causes of pain being multifactorial in 89% of cases; highlighting the need for a systematic diagnosis for the causes of pain before a course of management is decided (Kent et al 2015). Variations in the cause or causes of nipple pain may lead to difficulties identifying and selecting effective interventions. Amir et al (2015) have developed an integrated approach to breastfeeding pain assessment that seeks to enhance current practice by way of the Breastfeeding Pain Reasoning Model, which takes both physiological and psychological factors into account. They propose that the model can help healthcare practitioners identify the multifactorial influences on nipple pain and increase management strategies.

Description of the intervention

Following assessment and advice on optimal positioning and attachment, the management of breastfeeding problems includes: the continuation of breastfeeding where possible, the use of self-management techniques, the application of expressed breast milk to the nipple, pharmacological treatment for infection or identified skin conditions, and referrals for further specialist management where necessary (NICE 2017). There are numerous other interventions specifically for the treatment of nipple pain, such as the use of various topical applications, protective devices, dressings, and laser therapies; however, a stronger evidence base and higher quality studies are needed regarding their effectiveness. A dated but valuable systematic review by Morland-Schultz & Hill (2005) concluded that no one topical agent showed superior results in the relief of nipple discomfort and that the most important factor in decreasing the incidence of nipple pain is the provision of correct positioning and attachment education. This finding was based on two papers. In the first study, an experimental group who received a one-hour antenatal positioning and attachment teaching session had significantly lower nipple pain scores on the first four days postpartum and a significant difference in breastfeeding duration at six weeks with 92% (32/35) still breastfeeding compared to 29% (10/35) of controls (Duffy et al 1997). In the second study an experimental group, who received a 30-minute postpartum positioning and attachment education intervention conducted within 24 hours of birth, had a significantly lower number of women experiencing nipple pain on day 2 (31/79 vs 49/79) and day 3 (39/76 vs 50/74) only, with no significant difference for breastfeeding duration at six weeks, three months or six months compared to the control group (Henderson et al 2001). Dennis et al (2014), in their more recent Cochrane systematic review of interventions for treating painful nipples, focused on pharmacological and non-pharmacological interventions, dressing interventions, nipple protection interventions, LED phototherapy and expressed breast milk. The review included four trials

of good methodological quality involving 656 women and concluded that there was insufficient evidence to recommend glycerine pads, lanolin with breast shells, lanolin alone, or an all-purpose nipple ointment and that applying nothing or expressed breast milk may be equally or more beneficial in the short term. The authors note that the '*applicability of evidence from this review was not strong and the results should be interpreted with caution*' (Dennis et al 2014:24). As the review found that there was no recommended intervention to treat nipple pain, consideration was given to the importance of assisting mothers to prevent nipple trauma and pain, noting that trauma often results from incorrect latching or positioning. Positioning and attachment interventions, however, were not included in this systematic review.

How the intervention might work

There are numerous breastfeeding positions including laid-back or biological nurturing, cradle, cross-cradle, rugby or football and side-lying. As each breastfeeding dyad is unique, it is important for the mother to find a position that works for her and her baby (Wambach & Riordan 2016) as long as the baby's body is straight, close to the mother, supported and facing the breast (WHO 2009). Attachment refers to how the baby latches on to the breast; good signs include the baby's mouth wide open, chin touching the breast, lower lip rolled down, nose free, less areola visible underneath the chin than above the nipple and no pain (NICE 2006). Most mothers can achieve successful breastfeeding by '*mastering attachment*' (Amir 2014:5). Therefore, while it is a natural act, breastfeeding is also a learned behaviour (WHO 2019) and so positioning and attachment can be considered a modifiable skill. As poor positioning and attachment can result in nipple pain, interventions may improve technique, reduce the incidence, severity or duration of nipple pain and thereby may impact upon breastfeeding duration. Given the high incidence, early onset, potential duration and associated negative outcomes of nipple pain, the aim of the current review was to collate and examine the most up-to-date evidence to explore the effectiveness of positioning and attachment interventions.

Aims and objectives

1. To collate and synthesise the available evidence on the effectiveness of positioning and attachment interventions for the prevention and/or management of nipple pain in breastfeeding mothers.
2. To consider the effectiveness of:
    a. different **mediums** for positioning and attachment intervention delivery such as practical demonstrations using dolls/aids, brochures or videos
    b. different **modes of delivery** for positioning and attachment interventions, including face to face, online or telephone, as well as through group or individual settings
    c. the **timing** of intervention delivery, being antenatal, postnatal or both
    d. the **frequency** of the intervention, being either single or multiple episodes.
3. To examine the effectiveness of positioning and attachment interventions for nipple pain on breastfeeding duration.

Methods

Criteria for considering studies in this review

The scope of the review was defined by the Cochrane 'Population, Intervention, Comparison, Outcomes and Study design' (PICOS) tool (McKenzie et al 2019), see Table 1, and eligibility criteria were developed, see Table 2.

Table 1. PICOS tool.

Population	Breastfeeding mothers
Intervention	Positioning and attachment interventions
Comparison	Standard or routine care
Outcomes	Primary: nipple pain
	Secondary: breastfeeding duration
Study design	Experimental

The population of breastfeeding dyads included primiparous or multiparous mothers who participated in experimental studies (randomised or quasi-randomised controlled trials) examining the effectiveness of positioning and attachment interventions for nipple pain. These interventions could be delivered using a variety of methods, mediums, settings, groups sizes and be delivered by a professional or lay person at any point during the antenatal or postnatal period. Interventions did not include positioning and attachment as part of a wider breastfeeding (educational) programme. Interventions included variations in the literature for nipple pain, such as nipple damage, nipple trauma, nipple fissures

Table 2. Inclusion and exclusion criteria.

Inclusion	Exclusion
Publication date 1/1/2003–1/5/2020	Articles not available in English language
Experimental design	No nipple pain outcome or nipple pain not the primary outcome
Positioning and attachment interventions	Maternal or infant complications that may impact upon the ability to breastfeed or may require specific pharmacological or surgical intervention

or sore or cracked nipples or any of these variations referred to as breastfeeding problems. As positioning and attachment interventions may already form part of the maternity care experienced by mothers, the aim of this review was to consider interventions that went beyond the comparison of 'routine care', which may vary between studies. The primary outcome of nipple pain included the incidence or severity of pain and breastfeeding duration was a secondary outcome.

Exclusion criteria extended to studies with infants born at less than 37 weeks' gestation or the presence of maternal or infant complications such as: ankyloglossia, cleft lip and palate, Down's Syndrome, Raynaud's, inverted nipples, previous breast surgery, nipple infection or skin conditions, as they may impact upon the infant or mother's ability to breastfeed or may require specific pharmacological or surgical intervention. A decision was made to include research published from 2003 until the present based on the WHO (2003) recommendation concerning breastfeeding duration. This time frame was also chosen in light of earlier systematic reviews examining interventions for nipple pain, including Morland-Schultz & Hill (2005) whose search criteria extended from 1983 until 2004 and Dennis et al (2014) whose search criteria included papers up until 2014. Dennis et al (2014) did not include positioning and attachment interventions and Morland-Schultz & Hill's (2005) search only resulted in two studies that examined positioning and attachment interventions for nipple pain.

Searching the literature

A literature search strategy was developed in line with the PICOS tool and search terms were derived from the nipple pain literature, information contained in *Off to a good start* (Public Health Agency (PHA) 2018) which is given to new mothers, advice regarding breastfeeding techniques from La Leche League GB (2016) and *Breastfeeding problems* (NICE 2017). Terms were also derived from *Breastfeeding and human lactation* (Wambach & Riordan 2016), reading as recommended by a specialist infant feeding co-ordinator. The strategy and subsequent search were reviewed by two expert librarians.

The following databases were searched for the time period 1 January 2003 until 1 May 2020: MEDLINE, Embase, PsycInfo, CINAHL, Proquest Academic Complete, Web of Science and Cochrane Central Register of Controlled Trials (CENTRAL), which included records from ClinicalTrials.gov and the WHO's International Clinical Trials Registry Platform. Grey literature searches included the EThOS and Proquest Dissertations & Theses Global databases, Google Scholar, ResearchGate, the EU Clinical Trials Register, WHO and UNICEF publications and hand searches of reference lists from relevant NICE guidelines and research papers. Searches included both Medical Subject Headings (MeSH) and key words; concepts were combined under terms for 'breastfeeding' with a focus on 'nipple (problems)' and variations in the terminology for types of 'positioning and attachment' as an intervention using 'AND/OR' commands. (See Supplementary information, Table 8).

Selecting the studies

Following the search strategy, identified publications were assessed to be included in the final review based on the application of the PICOS tool and inclusion/exclusion criteria. The screening and eligibility process was conducted and reviewed by two authors, with any disagreements resolved through discussion and consultation with other team members. Details of excluded full texts are available on request due to word limit.

Data extraction and analysis

Data extracted from the included studies are presented in Table 3 (see Supplementary information). The methodological quality for each study was assessed using the revised Cochrane risk-of-bias tool for randomised trials (RoB2) (Sterne et al 2019) and the Risk Of Bias In Non-Randomized Studies of Interventions (ROBINS-I) tool for non-randomised designs (Sterne 2016a), by two members of the review team following the associated guidelines (Sterne et al 2016b, Higgins et al 2019). The overall findings are presented in Tables 4a and 4b (see Supplementary information).

Results

A total of 383 papers were identified from the database and grey literature searches. After duplicates were removed, 163 records were screened by title and abstract; 152 studies were excluded for reasons including: non-experimental design, the testing of other interventions outside the scope of this review, such as dressings and nipple shields or interventions targeted at dyads who may find breastfeeding more challenging, such as infants with ankyloglossia or mothers with inverted nipples. Of the 11 full-text articles that were assessed for eligibility, eight were excluded for the following reasons: no nipple pain outcome (n=4), non-experimental study design (n=2), nipple pain was not the primary outcome (n=1) and the intervention was not exclusively positioning and attachment (n=1). Three studies met the inclusion criteria and were included in the final review (see Figure 1).

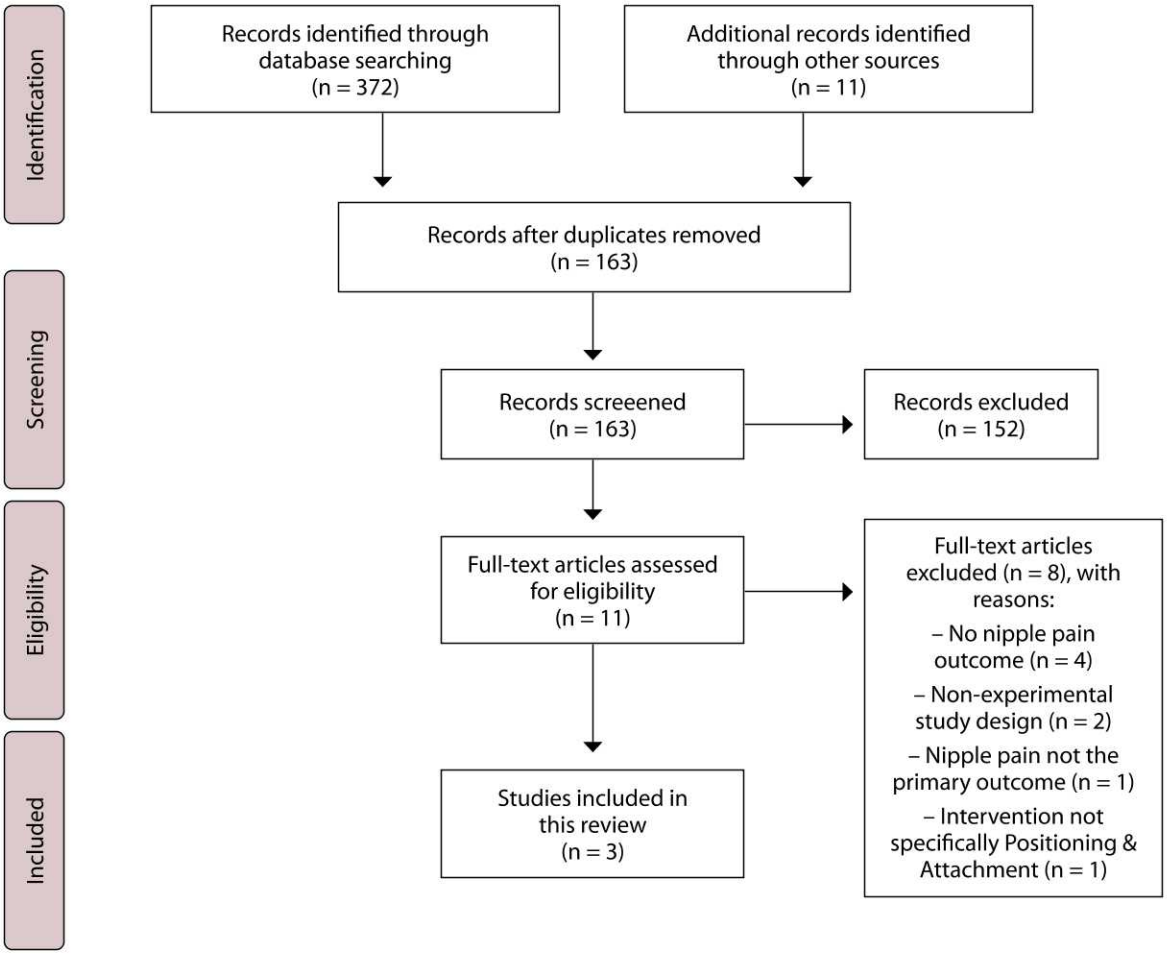

Figure 1. PRISMA flow diagram.

Included studies

The three remaining studies shall be discussed in chronological order: de Oliveira et al (2006), Eksioglu et al (2017) and Milinco et al (2020). Information concerning the specific details of the positioning and attachment interventions is presented in Table 5 (see Supplementary information). Information providing a summary of the results is detailed in Tables 6 and 7 (see Supplementary information).

In the study conducted by de Oliveira et al (2006), women were recruited postnatally in the maternity ward of a Baby Friendly-accredited hospital and randomised to either the routine care group (n=137) or the experimental group (n=74) on the day of hospital discharge to return home. Both groups received routine care during their postnatal stay that included: first breastfeed initiated in the first half hour after birth whenever possible, overall guidance on breastfeeding technique and practical help in the case of difficulties. The experimental group however, received a 30-minute counselling session on breastfeeding technique that consisted of a reinforcement of the information routinely given to mothers. This one-off session was conducted by two nurses, one a lactation consultant, in groups of no more than two mother–infant dyads. The intervention involved a discussion of '*proper mother and infant positioning and correct attachment of the child to the breast*' (de Oliveira et al 2006:317) following the WHO breastfeeding counselling principles (WHO 1993). Pictures, dolls and a model breast were used for demonstration purposes and the session was used as an opportunity to correct technical details and reinforce positive aspects among those who chose to breastfeed during the intervention. Data for the study were collected on three occasions: on the maternity ward prior to randomisation all mothers' breasts were examined for breastfeeding-related problems, including sore nipples, engorgement and mastitis, then a complete breastfeeding session was observed to assess proper position and latch based on indicators drawn from a WHO-recommended tool (WHO 1993). On day 7 infant feeding patterns and breastfeeding problems were assessed through breast examinations and mothers' reports. This was repeated on day 30 which also included another position and latch assessment. The primary outcomes were frequencies of exclusive breastfeeding and lactation-related problems at one month postpartum.

No significant differences were found between the groups in terms of exclusive breastfeeding, improving breastfeeding technique and reducing the incidence of breastfeeding problems during the first month. At days 7 and 30, the rate of sore nipples for the experimental and control groups were, respectively, 43.2% vs 48.9% (p>0.05) and 8.5% vs 9.1% (p>0.05). For the same time points and groups, exclusive breastfeeding rates were 79.7% vs 82.5% (p=760) and 60.8% vs 53.3% (p=365).

The next study by Eksioglu et al (2017) recruited mothers in the gynaecology clinic of a Baby Friendly-accredited hospital. The mothers were divided into one of three groups of 30 to be studied sequentially to avoid contamination bias, prior to hospital discharge: first the routine care group, then a brochure group and finally a demonstration-based training group. The routine care group did not undergo any 'special' interventions, care was given by the baby nurse working in the clinic and support was only given to those who asked. In the second group a brochure that contained pictures and information on breastfeeding positions, holding and grasping the breast and breast problems was given by the researchers to mothers, with their attention drawn to important points. No information was provided by the authors as to whether this was undertaken individually or in groups and how long this intervention lasted. Finally, the demonstration-based training group received a single coaching session on accurate and inaccurate positions through explanations, demonstrations and practices with feedback using a breast model, puppets, model doll and illustrated guidelines lasting an average of one hour. Again, no information was provided as to whether this was undertaken at an individual or group level or who delivered the demonstration. The aim of the study was to investigate the effects of the different techniques delivered before hospital discharge on the incidence of cracked nipples in primiparous mothers. The assessment of cracks was carried out through a breast examination under the supervision of a health professional. In terms of results, the demonstration-based group was significantly more effective at preventing nipple cracks than the other two groups at two weeks and four weeks postpartum. The difference between the groups was not significant at the hospital. However, it is not clear if the hospital assessment was carried out before or after the intervention. The incidence of nipple cracks for the routine, brochure and demonstration groups respectively were as follows: hospital 30% vs 20% vs 16.7% (p=0.434), at two weeks 63.3% vs 56.7% vs 20% (p=0.001) and at four weeks 30% vs 10% vs 6.7% (p=0.026). Latch scores increased for all groups between hospital discharge and week 4, with the demonstration group scoring significantly higher (p<0.05). The percentage of mothers exclusively breastfeeding in this group was also higher at all three time points, but the finding was not significant (hospital p=0.207, two weeks p=0.179, four weeks p=0.214).

Finally, Milinco et al (2020) enrolled mothers for their study during an antenatal ultrasound scan visit at 30/32 weeks' gestation. At enrolment, mothers were randomised to either the experimental group following the biological nurturing approach (n=90) or the usual care group based on the WHO/UNICEF breastfeeding 20-hour course (WHO & UNICEF 2009) (n=98). All mothers were given a video containing information that corresponded with their group allocation (experimental or usual care) and recommended to watch it prior to labour. After birth mothers were allocated to different rooms depending on their allocation group. During their postnatal stay, all healthcare staff looked after the mothers but were instructed to provide different support for each room accordingly. Mothers in the experimental group were supported by staff to breastfeed in a '*laid-back position, with their babies lying prone on their chests*' while mothers in the control group were supported and shown how to breastfeed their babies in the '*sitting upright position and helped to attach their babies correctly*' (Milinco et al 2020:3) based on the WHO/UNICEF course. The primary outcome was the incidence of breast problems during hospital stay, defined as the presence of one or more of the following outcomes collected separately: sore nipples, cracked nipples, engorgement and mastitis. The study had numerous secondary outcomes, gathered by phone, that included the incidence of these problems at days 7, 30 and 120 as well as exclusive breastfeeding for all time points. At hospital discharge the biological nurturing group (BN) had a significantly reduced risk of overall breast problems (RR 0.56, 95% CI 0.40, 0.79), cracked (RR 0.42, 95% CI 0.24, 0.74) and sore nipples (RR 0.59, 95% CI 0.40, 0.88). These results were confirmed at day 7 (with a relative risk reduction of 55% for breast problems, 60% for cracked nipples and 50% for sore nipples) but were no longer significant at day 30. At 120 days, again the BN group had a significantly reduced risk of overall breast problems, although it is unclear if this included cracked or sore nipples as this variable was defined as the presence of one or more of the four problems. At the four timepoints (discharge, day 7, day 30, day 120) the incidence of cracked nipples for the experimental and control groups respectively were: 14% vs 35%, 14% vs 34%, 16% vs 14% and 2% vs 7%. The same results for sore nipples were as follows: 28% vs 47%, 17% vs 34%, 20% vs 24% and 8% vs 17%. No significant difference between the groups for exclusive breastfeeding was detected at any time point.

Risk of bias of included studies

The risk of bias of included studies is detailed in Tables 4a and 4b (see Supplementary information). It is worth noting that the nature of these

interventions often meant that participants were aware of their allocation. Two studies recruited both primiparous and multiparous mothers (de Oliveira et al 2006 and Milinco et al 2020), which had the potential to bias results in terms of the effect of previous positioning and attachment experience. Eksioglu et al (2017) included primiparous mothers only. As these interventions were conducted in Baby Friendly Hospitals, or used the WHO/UNICEF breastfeeding support routinely, it is possible that mothers in the routine care groups would have had access to lactation consultants in the case of any breastfeeding difficulties; this limitation was acknowledged by de Oliveira et al (2006). Only one trial, Milinco et al (2020), conducted an intention-to-treat data analysis.

Discussion

Outcomes

This review summarised the results of two randomised controlled trials and one non-randomised study, involving 489 mothers from three different countries, namely Brazil, Turkey and Italy, at three different time points: 2006, 2017 and 2020. In terms of the primary outcome of nipple pain and secondary outcome of breastfeeding duration, a single postnatal positioning and attachment counselling session (practical demonstration) did not significantly reduce the incidence of nipple pain or increase the rate of exclusive breastfeeding at day 7 or day 30 postpartum (de Oliveira et al 2006). However, a single postnatal demonstration-based training session significantly reduced the incidence of nipple cracks compared to a brochure or routine care at two weeks and four weeks with a higher non-significant percentage of mothers exclusively breastfeeding (Eksioglu et al 2017). The only intervention to include an antenatal and postnatal component using a video and a postnatal biological nurturing approach to care resulted in a significantly reduced risk of cracked and sore nipples (outcomes collected individually) at hospital discharge and day 7 (Milinco et al 2020). This finding was no longer significant at day 30, and although the percentage of mothers exclusively breastfeeding in the experimental group was higher at all data collection timepoints, the finding was not significant. Therefore, the applicability of the evidence from this review should be interpreted with caution given the small number of studies, variations in design and conflicting results.

Completeness of the evidence

Two studies (de Oliveira et al 2006, Milinco et al 2020) examined the effectiveness of the interventions on breastfeeding problems that included, but were not specific to, nipple pain. Only Eksioglu et al (2017) examined nipple cracks specifically. In de Oliveira et al's (2006:316) study, sore nipples were defined as '*cracks, blisters, spots and/or ecchymosis*', in Eksioglu et al's (2017) study cracked nipples were defined as the presence of pain, pinkness, redness, oedema, crusting, scarring or bleeding, and in Milinco et al's (2020) study a differentiation is made between sore nipples (without fissures) and cracked nipples (presence of a fissure). This variation is reflective of the literature in relation to nipple pain which uses a variety of descriptive words. All three studies in this review assessed the effectiveness of positioning and attachment interventions on the incidence of nipple pain only. None of the studies used any tools to measure nipple pain severity or trauma nor did they gather any other nipple pain information, such as the causes of pain. A recent systematic review described the numeric rating scale and the visual analogue scale as the most prevalent tools for measuring pain. Based mostly on studies examining interventions for nipple pain it concluded that, by using these consistently, findings can be compared across studies (Coca et al 2019). No studies set pain and trauma as inclusion criteria and only one study assessed the incidence of pain before intervention delivery (de Oliveira et al 2006). It was not clear if the hospital assessment of nipple cracks was carried out before or after the intervention in Eksioglu et al's (2017) study and in Milinco et al's (2020) study outcomes were assessed after intervention delivery. A more thorough pain assessment before and after intervention delivery would enable more rigorous testing of intervention effectiveness. De Oliveira et al (2006) reported that breastfeeding problems were similar in both study groups. They suggest this result is in agreement with the fact that the intervention did not improve technique, which was assessed before and after intervention delivery. Eksioglu et al (2017) reported a significant increase in LATCH scores in their study and a significant reduction in nipple cracks, however scores were assessed after intervention delivery. It is not clear if Milinco et al (2020) measured breastfeeding technique, although the authors suggest their significant results for nipple pain may be explained by a higher proportion of successful latching in the experimental group. Again, similar to assessing nipple pain before and after intervention delivery, the assessment of positioning and attachment parameters at both time points would enable studies to assess if their intervention actually improves breastfeeding technique.

Breastfeeding duration outcomes were reported in hospital, at seven days, two weeks, approximately four weeks and 120 days. No study included a six-month outcome duration; the current WHO recommendation. Milinco et al (2020) was the only study that had an intention to breastfeed as part of the inclusion criteria. Across studies, exclusive breastfeeding rates ranged from 53.3% to 82.5% (de Oliveira et al 2006), 40% to 80% (Eksioglu et al 2017) and 65% to 87% (Milinco et al 2020).

The rates for any breastfeeding across both groups in two of the studies ranged from 87% to 100% (Milinco et al 2020) and 100% (Eksioglu et al 2017). Therefore, the effectiveness of any intervention on breastfeeding duration may be limited when any and exclusive breastfeeding rates are already high.

The results from this review also create challenges in terms of identifying the characteristics of effective positioning and attachment intervention delivery. As mentioned, two interventions were delivered on the day of postnatal hospital discharge (de Oliveira et al 2006, Eksioglu et al 2017), which may have been too late. The only study to assess nipple pain before intervention delivery (de Oliveira et al 2006) reported 43.2% of the experimental group and 43.8% of the control group had sore nipples suggesting that interventions need to be in place as early as possible in a mother's breastfeeding experience. Only one study, Milinco et al (2020), included an intervention that had both antenatal and postnatal components. All experimental interventions were delivered face to face with limited information on group sizes. In the first study, two nurses delivered the intervention in groups of no more than two mother infant pairs (de Oliveira et al 2006). No information on staff or group size was provided for the second study (Eksioglu et al 2017). The more recent study (Milinco et al 2020) involved all staff normally involved in maternity ward activities providing support depending on the mother's room allocation, which presumably would have included one-to-one support as part of general postnatal care. No information was provided concerning the number of mothers in each room, or the ratio of staff to participants. With regard to frequency, the two demonstration-based interventions occurred at one single time point and lasted 30 minutes (de Oliveira et al 2006) and approximately one hour (Eksioglu et al 2017), whereas the biological nurturing approach consisted of care that lasted the duration of the mothers' postnatal hospital stay (Milinco et al 2020), therefore, increasing the opportunities for the intervention to be reinforced. In terms of the media used to demonstrate positioning and attachment, the two demonstration-based interventions (de Oliveira et al 2006, Eksioglu et al 2017) used puppets, dolls, pictures and model breasts. Both studies reported different results in terms of the significant effect of the intervention on nipple pain and breastfeeding technique, therefore it is important to consider the effectiveness of the 'trainer' in delivering these interventions. It was detailed that these studies were conducted in Baby Friendly hospitals (de Oliveira et al 2006, Eksioglu et al 2017) and a maternity ward that used WHO/UNICEF support routinely (Milinco et al 2020). Definitions of the positioning and attachment interventions were provided for two studies (de Oliveira et al 2006, Milinco et al 2020) and only one study reported that staff received training prior to intervention delivery (Milinco et al 2020). There were also variations in terms of who provided the intervention. In de Oliveira et al's (2006) study the intervention was delivered by two nurses, one of whom was also a lactation consultant. Eksioglu et al's (2017) brochure group was delivered by the researchers, with no information concerning their background and no detail about who delivered the demonstration-based intervention. As mentioned, in Milinco et al's (2020) study, all staff who normally looked after mothers provided care for both study groups. Only one study provided mothers with a brochure with written and illustrated information (Eksioglu et al 2017). Only one study, Milinco et al (2020), provided mothers with a video to watch in the antenatal period, which may help them prepare for the intervention and breastfeeding.

Agreements with previous research

Several reviews have been conducted examining the prevention and treatment of breastfeeding-related nipple pain and trauma (Page et al 2003, Morland-Schultz & Hill 2005, Vieira et al 2013, Dennis et al 2014, Niazi et al 2018). Most of the studies identified in these reviews include the use of various topical applications, dressings and protective devices with fewer studies concerning positioning and attachment. Nevertheless they advocate the potential of positioning and attachment interventions for nipple pain and trauma, identifying this as an area for further research; a finding shared in the current review.

Implications for practice and research

It is important to note that when considering the causes and clinical management of nipple pain, poor positioning and attachment can be viewed as a cause, while optimal positioning and attachment can be regarded as a preventative measure or management intervention. Although efforts can be made to improve mothers' knowledge about the prevention and management of nipple problems, breastfeeding is a practical skill. Kent et al (2015) suggest positioning and attachment may need to be assessed more than once during the first weeks and advice on correction of positioning and attachment may need to be repeated. Therefore, an integrative approach of increasing knowledge and support may be more beneficial. It is important for studies to identify if interventions actually improve technique, as well as to assess the effectiveness on other outcomes such as pain or breastfeeding duration.

When breastfeeding support is offered to mothers, the duration and exclusivity of breastfeeding is increased (McFadden et al 2017). It is important to acknowledge the potential impact that being part of a breastfeeding research study may have in terms of additional attention and support. It may be this extra support, or the influence of the Hawthorne effect whereby an individual's behaviour is changed

due to an awareness of being observed, that is having an impact on study outcomes as opposed to the specific intervention itself. In addition, it is essential to determine if interventions can be delivered as intended. Issues can arise, including the lack of staff availability to deliver the intervention (Wallace et al 2006) or staff having limited time to provide individualised support due to their intensive workload (Eksioglu et al 2017). Conversely, Milinco et al (2020) describe their study design as pragmatic, as it requires no equipment, minimal training and can be delivered by all staff who have a shared responsibility of looking after mothers during their postnatal hospital stay. It is important to consider the comparator of routine care and what study interventions offer over and above this that can make a difference.

Findings from this review suggest it may be challenging for researchers deciphering whether study results are due to the intervention itself, effective intervention delivery or extra support being part of a research study. Furthermore, two of the three included studies (Eksioglu et al 2017 and Milinco et al 2020) could be regarded as successful for breastfeeding problems and improving technique but not for duration. Although this is an important outcome, it may be beyond the scope of a single intervention given the complexity of breastfeeding behaviour.

Limitations

The current review had a very specific focus examining the effectiveness of positioning and attachment interventions for the primary outcome of nipple pain. Due to the low number of studies, findings must be interpreted with caution. A strength however, included the rigorous methodology that was used to undertake this review in order to identify the existing evidence.

Conclusions

There is insufficient evidence to determine the effectiveness of positioning and attachment interventions for nipple pain or breastfeeding duration. Subsequently, there is not enough information to recommend any specific intervention study design. However, an important finding from this review was the absence of information regarding pain measurement. Another finding was the importance of identifying if the intervention actually improves technique as a potentially confounding variable. Constraints on staff time are well known, and studies need to be realistic if they are to be delivered as intended. As nipple pain was prevalent during mothers' postnatal hospital stay in all three studies, it may be beneficial to prepare mothers for the possibility of this outcome during the antenatal period.

Authors

Sharon Guille. BSc. PhD Researcher. Centre for Maternal, Fetal and Infant Research at Ulster University, Jordanstown Campus, Institute of Nursing and Health Research, Shore Road, Newtownabbey, County Antrim, BT37 0QB. Email: guille-s1@ulster.ac.uk

Marlene Sinclair. PhD, MEd, PGDip/ED, BSc, RM. Professor of Midwifery Research and Head of the Centre for Maternal, Fetal and Infant Research at Ulster University, Jordanstown Campus, Institute of Nursing and Health Research, Shore Road, Newtownabbey, County Antrim, BT37 0QB. Email: m.sinclair1@ulster.ac.uk

Brendan Bunting. PhD. Professor of Psychology. School of Psychology, Faculty of Life and Health Sciences at Ulster University, Coleraine Campus, Cromore Road, Coleraine, County Londonderry, BT52 1SA. Email: bp.bunting@ulster.ac.uk

Bernie Reid. PhD, MSC, PgCertTHE, BSc, RGN, RM, RPHN, FHEA. Lecturer in Nursing/Course Director Preregistration Adult Nursing. School of Nursing. Ulster University, Magee Campus, Northland Road, Londonderry, BT48 7JL. Email: bb.reid@ulster.ac.uk

Paul A. McCarron. PhD, BSc, MPSNI. Head of School of Pharmacy and Pharmaceutical Sciences. Ulster University, Coleraine Campus, Cromore Road, Coleraine, County Londonderry, BT52 1SA. Email: p.mccarron@ulster.ac.uk

Funding

This systematic review was undertaken as part of a wider PhD study exploring breastfeeding-related nipple pain. The study is funded by the Department for the Economy (DfE), Northern Ireland.

References

Amir LH (2014). Managing common breastfeeding problems in the community. *BMJ* 348:g2954.

Amir LH, Jones LE, Buck ML (2015). Nipple pain associated with breastfeeding: incorporating current neurophysiology into clinical reasoning. *Australian Family Physician* 44(3):127-32.

Brown A, Rance J, Bennett P (2016). Understanding the relationship between breastfeeding and postnatal depression: the role of pain and physical difficulties. *Journal of Advanced Nursing* 72(2):273-82.

Buck ML, Amir LH, Cullinane M, Donath SM (2014). Nipple pain, damage and vasospasm in the first 8 weeks postpartum. *Breastfeeding Medicine* 9(2):56-62.

Coca KP, Amir LH, da Silva Alves MDR, Barbieri M, Marcacine KO, Abrão ACFdV (2019). Measurement tools and intensity of nipple pain among women with or without damaged nipples: a quantitative systematic review. *Journal of Advanced Nursing* 75(6):1162-72.

de Oliveira LD, Giugliani ERJ, do Espírito Santo LC, França MCT, Weigert EML, Kohler CVF, Bonilha ALdL (2006). Effect of intervention to improve breastfeeding technique on the frequency of exclusive breastfeeding and lactation-related problems. *Journal of Human Lactation* 22(3):315-21.

Dennis C-L, Jackson K, Watson J (2014). Interventions for treating painful nipples among breastfeeding women. *Cochrane Database of Systematic Reviews*, Issue 12. Art. No.:CD007366. DOI: 10.1002/14651858.CD007366.pub.2.

Dias JS, Vieira TO, Vieira GO (2017). Factors associated to nipple trauma in lactation period: a systematic review. *Revista Brasileira de Saude Materno Infantil* 17(1):27-42.

Duffy EP, Percival P, Kershaw E (1997). Positive effects of an antenatal group teaching session on postnatal nipple pain, nipple trauma and breast feeding rates. *Midwifery* 13(4):189-96.

Eksioglu A, Yesil Y, Demir Gungor D, Ceber Turfan E (2017). The effects of different breastfeeding training techniques given for primiparous mothers before discharge on the incidence of cracked nipples. *Breastfeeding Medicine* 12(5):311-15.

Henderson A, Stamp G, Pincombe J (2001). Postpartum positioning and attachment education for increasing breastfeeding: a randomized trial. *Birth* 28(4):236-42.

Higgins JPT, Savović J, Page MJ, Elbers RG, Sterne JAC (2019). Chapter 8: Assessing risk of bias in a randomized trial. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA *eds. Cochrane handbook for systematic reviews of interventions*. Version 6.0. www.training.cochrane.org/handbook [Accessed 7 April 2020].

Kent JC, Ashton E, Hardwick CM, Rowan MK, Chia ES, Fairclough KA, Menon LL, Scott C, Mather-McCaw G, Navarro K, Geddes DT (2015). Nipple pain in breastfeeding mothers: incidence, causes and treatments. *International Journal of Environmental Research and Public Health* 12(10):12247-63.

La Leche League GB (2016). *Positioning & attachment*. https://www.laleche.org.uk/positioning-attachment [Accessed 10 August 2019].

Li R, Fein SB, Chen J, Grummer-Strawn LM (2008). Why mothers stop breastfeeding: mothers' self-reported reasons for stopping during the first year. *Pediatrics* 122(suppl 2):S69-76.

Lucas R, McGrath JM (2016). Clinical assessment and management of breastfeeding pain. *Topics in Pain Management* 32(3):1-11.

McClellan HL, Hepworth AR, Garbin CP, Rowan MK, Deacon J, Hartmann PE, Geddes DT (2012). Nipple pain during breastfeeding with or without visible trauma. *Journal of Human Lactation* 28(4):511-21.

McFadden A, Gavine A, Renfrew MJ, Wade A, Buchanan P, Taylor JL, Veitch E, Rennie AM, Crowther SA, Neiman S, MacGillivray S (2017). Support for healthy breastfeeding mothers with healthy term babies. *Cochrane Database of Systematic Reviews* Issue 2. Art. No.: CD001141. DOI: 10.1002/14651858.CD001141.pub5.

McKenzie JE, Brennan SE, Ryan RE, Thomson HJ, Johnston RV, Thomas J (2019). Chapter 3: Defining the criteria for including studies and how they will be grouped for the synthesis. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA *eds. Cochrane handbook for systematic reviews of interventions*. Version 6.0. www.training.cochrane.org/handbook [Accessed 16 September 2020].

Milinco M, Travan L, Cattaneo A, Knowles A, Sola MV, Causin E, Cortivo C, Degrassi M, Di Tommaso F, Verardi G, Dipietro L, Piazza M, Scolz S, Rossetto M and Ronfani L (2020). Effectiveness of biological nurturing on early breastfeeding problems: a randomized controlled trial. *International Breastfeeding Journal* 15:21. https://doi.org/10.1186/s13006-020-00261-4 [Accessed 14 July 2020].

Morland-Schultz K & Hill PD (2005). Prevention of and therapies for nipple pain: a systematic review. *Journal of Obstetric, Gynecologic and Neonatal Nursing: JOGNN* 34(4):428-37.

National Institute for Heath and Care Excellence (NICE) (2006). *Postnatal care up to 8 weeks after birth. Clinical guideline CG37*. https://www.nice.org.uk/guidance/cg37/chapter/1-Recommendations#infant-feeding [Accessed 25 October 2017].

National Institute for Heath and Care Excellence (NICE) (2017). *Breastfeeding problems*. https://cks.nice.org.uk/breastfeeding-problems#!topicsummary [Accessed 21 October 2017].

Niazi A, Rahimi VB, Soheili-Far S, Askari N, Rahmanian-Devin P, Sanei-Far Z, Sahebkar A, Rakhshandeh H, Askari VR (2018). A systematic review on prevention and treatment of nipple pain and fissure: are they curable? *Journal of Pharmacopuncture* 21(3):139-50. doi:10.3831/KPI.2018.21.017 [Accessed 14 July 2020].

Odom EC, Ruowei L, Scanlon KS, Perrine CG, Grummer-Strawn L (2013). Reasons for earlier than desired cessation of breastfeeding. *Paediatrics* 131(3):e726-32.

Page T, Lockwood C, Guest K (2003). Management of nipple pain and/or trauma associated with breast-feeding. *JBI Reports* 1(4):127-47.

Pollard M (2017). *Evidence-based care for breastfeeding mothers*. 2nd ed. London: Routledge.

Public Health Agency (PHA) (2018). *Off to a good start: all you need to know about breastfeeding your baby*. https://www.publichealth.hscni.net/publications/good-start [Accessed 10 August 2019].

Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, Henry D, Altman DG, Ansari MT, Boutron I, Carpenter JR, Chan A-W, Churchill R, Deeks JJ, Hróbjartsson A, Kirkham J, Jüni P, Loke YK, Pigott TD, Ramsay CR, Regidor D, Rothstein HR, Sandhu L, Santaguida PL, Schünemann HJ, Shea B, Shrier I, Tugwell P, Turner L, Valentine JC, Waddington H, Waters E, Wells GA, Whiting PF, Higgins JPT (2016a). ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ* 355:i4919.

Sterne JAC, Higgins JPT, Elbers RG, Reeves BC and the development groups for ROBINS-I (2016b). Risk of bias in non-randomised studies of interventions (ROBINS-I): detailed guidance updated 12 October 2016. http://www.riskofbias.info [Accessed 10 April 2020].

Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, Cates CJ, Cheng H-Y, Corbett MS, Eldridge SM, Emberson JR, Hernán MA, Hopewell S, Hróbjartsson A, Junqueira DR, Jüni P, Kirkham JJ, Lasserson T, Li T, McAleenan A, Reeves BC, Shepperd S, Shrier I, Stewart LA, Tilling K, White IR, Whiting PF, Higgins JPT (2019). RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 366:l4898.

The Lancet Breastfeeding Series (2016). *Breastfeeding: achieving the new normal*. https://www.thelancet.com/series/breastfeeding [Accessed 18 November 2017].

Vieira F, Bachion MM, Mota DDCF, Munari DB (2013). A systematic review of the interventions for nipple trauma in breastfeeding mothers. *Journal of Nursing Scholarship* 45(2): 116-25.

Wagner EA, Chantry CJ, Dewey KG, Nommsen-Rivers LA (2013). Breastfeeding concerns at 3 and 7 days postpartum and feeding status at 2 months. *Paediatrics* 132(4):e865-75.

Wallace LM, Dunn OM, Alder EM, Inch S, Hills RK, Law SM (2006). A randomised-controlled trial in England of a postnatal midwifery intervention on breast-feeding duration. *Midwifery* 22(3):262-73.

Wambach K & Riordan J (2016). *Breastfeeding and human lactation*. Enhanced 5th ed. Burlington, VT: Jones and Bartlett Learning.

World Health Organization (WHO) (1993). *Breastfeeding counselling: a training course*. https://www.who.int/maternal_child_adolescent/documents/who_cdr_93_3/en/ [Accessed 1 May 2020].

World Health Organization (WHO) (2003). *The global strategy for infant and young child feeding*. Geneva: WHO. http://apps.who.int/iris/bitstream/10665/42590/1/9241562218.pdf?ua=1&ua=1 [Accessed 7 October 2017].

World Health Organization (WHO) (2009). *Session 2: The physiological basis of breastfeeding*. In: *Infant and young child feeding*. Geneva: WHO. https://www.ncbi.nlm.nih.gov/books/NBK148970/ [Accessed 9 December 2017].

World Health Organization (WHO) (2011). *Exclusive breastfeeding for six months best for babies everywhere*. Media Centre Statement. Geneva: WHO. https://www.who.int/mediacentre/news/statements/2011/breastfeeding_20110115/en/ [Accessed 2 June 2020].

World Health Organization (WHO) (2019). *Exclusive breastfeeding for optimal growth, development and health of infants*. Geneva: WHO. https://www.who.int/elena/titles/exclusive_breastfeeding/en/ [Accessed 30 April 2020].

World Health Organization (WHO) & UNICEF (2009). *Breastfeeding promotion and support in a Baby-friendly hospital: a 20-hour course for maternity staff*. https://www.who.int/nutrition/publications/infantfeeding/bfhi_trainingcourse_s3/en/ [Accessed 1 May 2020].

Guille S, Sinclair M, Bunting B et al. Evidence Based Midwifery, MIDIRS Midwifery Digest, vol 30, no 3, September 2020, pp 293-306.

Sharon Guille: Submitted: 19 May 2020 / Accepted: 5 June 2020 / Published: 1 September 2020.

How to cite this paper:

Guille S, Sinclair M, Bunting B, Reid B, McCarron PA (2020). Positioning and attachment interventions for nipple pain: a systematic review. *Evidence Based Midwifery, MIDIRS Midwifery Digest* 30(3):293-306.

Supplementary information

Table 3. Data extraction from included studies.

Study/ methodology/ location	Participants	Intervention	Comparison	Power calculation	Primary outcome measure	Results	Comments
de Oliveira et al (2006) Two-armed RCT Porto Allegre, Brazil	233 eligible 211 analysed (12 declined participation, 9 dropouts, one incomplete data record) Breastfeeding mothers	Postnatal reinforcement counselling session on breastfeeding technique in groups of no more than two mother–infant pairs, conducted on the day of discharge	Routine care which included overall guidance on breastfeeding technique and practical help in the case of any difficulties	Sample size of 211 sufficient to give the study a power > 80%	Exclusive breastfeeding and lactation related problems (sore nipples, engorgement, mastitis) at one month postpartum	No significant difference in nipple pain between intervention and control at day 7 (43.2% vs 48.9%) and day 30 (8.5% vs 9.1%)	The intervention did not improve breastfeeding technique. No significant differences between the two groups for exclusive breastfeeding.
Eksioglu et al (2017) Three-armed CT Izmir, Turkey	90 participants recruited and analysed	Postnatal intervention with two arms: 1. Brochure group with breastfeeding positions information 2. Demonstration group on breastfeeding positions with practice and feedback	Routine care, did not undergo any 'special' interventions and support only given to those who asked	Sample size calculated on NCSS PASS power analysis and sample size calculator by taking the incidence of nipple cracks as 46%, power = 80%	Incidence of cracked nipples in hospital, two weeks' and four weeks' duration	No significant difference between the groups in the incidence of nipple cracks in hospital but significant at two weeks and four weeks. Demonstration group: 16.7%, 20%, 6.7%. Brochure group: 20%, 56.7%, 10%. Routine care group: 30%, 63.3%, 30% at each time point respectively	Only significant increase in LATCH score observed in demonstration group. Percentage of mothers exclusively breastfeeding in this group was higher than the other two but not significant.
Milinco et al (2020) Two-armed RCT Trieste, Italy	229 assessed for eligibility 208 randomized 188 analysed	Antenatal video given to participants to watch and postnatal support based on biological nurturing / laid back approach	Routine care included antenatal video to watch and postnatal support based on WHO/ UNICEF course (breastfeeding in a sitting upright position)	For a reduction in breast problems from 40-20% using BN approach, sample of 94 in each group with power = 80%	Incidence of breast problems during hospital stay defined as the presence of one or more of the following outcomes collected separately: sore nipples, cracked nipples, engorgement and mastitis	Experimental group significant reduced risk at discharge for cracked nipples (14% vs 35%) and sore nipples (28% vs 47%) and day 7 for cracked nipples (14% vs 34%) and sore nipples (17% vs 34%)	First RCT on biological nurturing approach. No significant differences between the two groups for exclusive breastfeeding.

Table 4a. Risk of bias in included studies (RoB2).

Study/type	Randomisation process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported results
de Oliveira et al (2006) RCT	High	Low	Low	Low	Some concerns
Milinco et al (2020) RCT	Low	Some concerns	Low	High	High

Table 4b. Risk of bias in included studies (ROBINS-I).

Study/type	Bias due to confounding	Bias in selection of participants	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported result
Eksioglu et al (2017) Non-randomised controlled study	Critical	No information	Moderate	Low	Low	No information	Low

Table 5. Characteristics of the intervention from included studies.

Study	Definition of the positioning and attachment intervention	Timing/place	Delivered by	Medium	Mode	Duration/ frequency
de Oliveira et al (2006)	Based on WHO principles unfavourable indicators: Position (unrelaxed mother with tense shoulders, infant distant from mother, infant's head and trunk not aligned, infant's chin not touching the breast, infant not firmly supported) Latch (mouth not open wide, lips not flared outward, and a non-asymmetric latch)	Postnatal intervention, conducted on the day of discharge Maternity ward in a BFI-accredited hospital	Two nurses (one was also a lactation consultant)	Pictures, dolls, model breast	Face to face Groups of no more than two mother–infant pairs	30-minute session Single dose
Eksioglu et al (2017) * Group 1 =control	'Correct positioning and attachment', 'accurate and inaccurate breast holding positions, how to position the baby, and how to position the breast' stated in paper. Informed proper positioning and attachment explained or demonstrated; however it is not clearly defined what this means	Postnatal intervention conducted prior to discharge Gynaecology clinic in a BFI-accredited hospital	Group 2 – researchers Group 3 – ?	Group 2 – brochure with written and illustrated information Group 3 – dolls, puppets, model breast, illustrated guidelines	Groups 2 and 3 – face to face No information if either group delivered at individual or group level	Group 2 – no duration information/ single dose Group 3 – average one hour/single dose

Milinco et al (2020)	Biological nurturing approach – mothers supported to breastfeed in a relaxed, laid-back position, with their babies lying prone on their chests. This position promotes the baby's movements, activating primitive neonatal reflexes.	Antenatal (30/32 weeks) and postnatal from delivery to discharge Maternity ward that uses WHO/UNICEF breastfeeding support routinely	All healthcare staff involved in maternity ward activities	Antenatal video and postnatal care approach	Antenatal video given as a DVD, email link or USB Postnatal – face-to-face care, no information how many mothers in each allocation room	Antenatal and postnatal – no information for length of video or hospital stay/ No information if mothers watched video or frequency of interactions with healthcare staff. Potential to be multiple times.

Table 6. Summary of results for the incidence of the primary outcome.

Study	Intervention arm	Incidence of the primary outcome (nipple pain)				
		Hospital	Day 7	Two weeks	30 days/four weeks	Day 120
de Oliveira et al (2006) *No significant differences between the groups at any time point*	**Experimental**	43.20% (assessed before intervention delivery)	43.20%	X	8.50%	X
	Control	43.80% (assessed before intervention delivery)	48.90%	X	9.10%	X
Eksioglu et al (2017) *No significant difference between the groups at hospital* *Significant difference at two weeks and four weeks*	**Experimental (demonstration)**	16.70%	X	20.00%	6.70%	X
	Experimental 2 (brochure)	20.00%	X	56.70%	10.00%	X
	Control	30.00%	X	63.30%	30.00%	X
Milinco et al (2020) *Significantly reduced risk of cracked and sore nipples for the experimental group at hospital and day 7. Not significant at day 30. Significant reduced risk of overall problems at day 120.*	**Experimental**	Cracked 14.00% Sore 28.00%	Cracked 14.00% Sore 17.00%	X	Cracked 16.00% Sore 20.00%	Cracked 2.00% Sore 8.00%
	Control	Cracked 35.00% Sore 47.00%	Cracked 34.00% Sore 34.00%	X	Cracked 14.00% Sore 24.00%	Cracked 7.00% Sore 17.00%

Table 7. Summary of results for the incidence of the secondary outcome.

Study	Intervention arm	Incidence of the secondary outcome (breastfeeding duration)				
		Hospital	Day 7	Two weeks	30 days/four weeks	Day 120
de Oliveira et al (2006)	**Experimental**	X	EBF 79.70%	X	EBF 60.80%	X
No significant differences between the groups at any time point	**Control**	X	EBF 82.50%	X	EBF 53.30%	X
Eksioglu et al (2017) * = Any breastfeeding EBF = exclusive breastfeeding PB = predominant breastfeeding BF&F = breastfeeding and formula feeding	**Experimental (demonstration)**	**100.00%*** EBF 80.0% BF&F 20.0%	X	**100.00%*** EBF 66.70% PB 26.70% BF&F 6.70%	**100.00%*** EBF 73.30% PB 16.70% BF&F 10.00%	X
	Experimental 2 (brochure)	**100.00%*** EBF 63.30% BF&F 36.70%	X	**100.00%*** EBF 53.40% PB 33.30% BF&F 13.30%	**100.00%*** EBF 60.00% PB 26.70% BF&F 13.30%	X
No significant differences between the groups at any time point	**Control**	**100.00%*** EBF 60.00% BF&F 40.00%	X	**100.00%*** EBF 40.00% PB 33.30% BF&F 26.70%	**100.00%*** EBF 43.30% PB 20.00% BF&F 23.30%	X
Milinco et al (2020) * = Any breastfeeding EBF = exclusive breastfeeding PB = predominant breastfeeding PartBF = partial breastfeeding EFF = exclusive formula feeding	**Experimental**	**100.00%*** (Hospital stay) EBF 82.00% PartBF 18.00% (At discharge) EBF 89.00% PartBF 11.00%	**100.00%*** EBF 87.00% PartBF 14.00%	X	**95.00%*** EBF 81.00% PB 1.00% PartBF 14.00% EFF 5.00%	**92.00%*** EBF 71.00% PartBF 21.00% EFF 8.00%
No significant differences between the groups at any time point	**Control**	**100.00%*** (Hospital stay) EBF 86.00% PartBF 14.00% (At discharge) EBF 82.00% PartBF 18.00%	**100.00%*** EBF 78.00% PartBF 22.00%	X	**98.00%*** EBF 76.00% PartBF 22.00% EFF 2.00%	**87.00%*** EBF 65.00% PartBF 22.00% EFF 13.00%

Table 8. Search terms.

Main theme	Focus	Intervention
breastfeeding breastfeed* "breast feed*" breastfed "breast fed" lactation lactat*	nipple* nipple(s) **chose nipple* to capture nipple pain, nipple damage, nipple trauma, nipple fissures as advised by expert librarian.*	"positioning and attachment" "position* and attach*" "position* and latch*" "improve latch" latch "fit and hold" "breast feed* position*" "breastfeed* position*" **Types of breastfeeding positions and holds:** • Cradle hold • Cross-cradle hold • Crossover hold • Rugby/Football/Clutch hold • Koala hold • Underarm hold • Side* position • Lying position • Sitting/Upright/Vertical /Straddle* position • Semi-recline* position • Laid back breastfeed*/laid back breast feed*/biological nurture*